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| 2018 First Nation Launch |
| Post Launch Assessment Report |
| For Wisconsin Space Grant Consortium |

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| [School Name]  [Date] |

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# Team Information

School Name: Nueta Hidatsa Sahnish College

Location: New Town, ND

Team Name: Starseed Ascension

School Advisor: Ann Vallie, Teri Allery

Team:

Bobby Lee, Team Lead – Business Administration

Janna Steen, Safety Officer – Sustainable Technology Management

Michael Medeiros, Avionics – Computer Science

Tashunka Cook, Simulations – Pre-Engineering

Lizette Alvarez, Project Management Coordinator – Environmental Science

James Clement, Structure Engineer – Pre-Engineering

NAR/TRA Mentor: Frank Nobile

NAR/TRA Membership: # 04077

NAR/TRA Certification: Level 3

# Summary of PLAR Report

## Launch Vehicle Summary

Our teams launch Day Vehicle Totaled 14.3 lbs with the motor. The simulated rocket weight was roughly 15.5 lbs. We utilized the Aerotech K550w Motor for our launch day. This was one of the main reasons our rocket needed mass added. The wind, however, played a crucial role in keeping our rocket from going passed the apogee ceiling of 5000 feet. Our teams’ calculations were very precise in keeping the rocket from going passed this 5000-foot mark.

Through the simulations on openrocket software we were able to find a close approximation of our rockets apogee mark when factoring the mass and motor capabilities. This mark was simulated to be 4952 feet exactly. This was very close to our actual altitude of 4921 feet AGL.

## Payload Summary

* Summarize payload/challenge solution

# Vehicle Criteria

## Vehicle Summary

* Discuss the vehicle performance, at a high level

There were a few unexpected setbacks that we had to fix with our vehicle prior to launch. This was primarily our RRC3 altimeter which shorted 8 hours prior to launch day. This caused us to use our redundant altimeter, the RRC2 Mini, as our primary source of altitude calculations and deployment of parachutes at apogee and 600 feet. The reason for this being tricky is that the RRC2 didn’t have an inlet for the switch button to turn it on and off. So our team wired it in a way that when we turn on the switch button it will complete the circuit and arm our RRC2.

There were a few anomalies with our vehicle during our flight. Our rocket was off by by 1.2 lbs. This was actually a good scenario for our team because of the high winds during our launch day. The winds were on average about 10 mph and gusts up to 14 mph. This was crucial to keeping our rocket from moving passed our competitions ceiling of 5000 feet which we achieved. The anomaly here was that our calculations were very precise to a percentage of 99.4% within our calculated target altitude. We didn’t have too much faults with our rocket. Everything on our rocket was meant to be functional down to the paint job.

## Data Analysis and Mission Performance Summary

* Discuss the flight performance data
  + Compare predicted versus actual performance (speed, altitude, acceleration, stability, drift, etc.)
  + Show and discuss plots of the flight data; compare to simulated data

Bros given the flight time you can use sims but also this formula:

<https://en.wikipedia.org/wiki/Tsiolkovsky_rocket_equation>

and the thrust curve for our engine with total mass and mass after burnout

<http://www.thrustcurve.org/motorsearch.jsp?id=326>

Good shit man… we got this.. WE WILL WIN. WE SHALL PREVAIL!!

# Payload Criteria

## Payload Summary

Our payload performed at optimum levels. It had cycled through at least 3120 data collections before launch, equivalent to about an hour of runtime. Using an Arduino Uno and solderless breadboard we were able to collect and analyze our three data sources. Our temperature sensor and vibration sensor utilized the analog input giving a workable VDC reading. The pressure sensor and SD card breakout utilized the SPI serial bus to read and write data. Our sensors behaved as expected, the temperature sensor did register mild fluctuations throughout the flight of the vehicle. Our pressure reading was uniform save one anomaly during the initial ascent of the vehicle. Vibration was at consistently maximum levels throughout most of the vehicles descent. A likely addition to our sensor input will be an accelerometer and gyroscope.

## Data Analysis and Payload Performance Summary

We analyzed three different sensor inputs written to a text document in string format. This text was analyzed by converting to a csv format and running a python script to extract the data. The three different reading we analyzed were: Pressure, measured in PSI (pounds per square inch), Temperature, measures in Fahrenheit, and Vibration measured on a scale from 0 – 5 (per the voltage reading). The pressure measured initially and consistently at 14.2 – 14.25 psi. The pressure began decreasing as the launch vehicle climbed to its peak at which point it then began to decrease until it returned to normal levels. Our lowest pressure reading was 11.83 psi at 16 seconds which would likely correspond to apogee. There was a momentary spike in pressure around 8.6 seconds which is yet to be explained. The temperature fluctuated throughout flight, beginning at about 68 degrees. It decreased by about 1 degree during flight and hit its first low point of 66.21 at about 28 seconds. It is likely that the constant motion of descent and air flowing around the vehicle caused these fluctuations. Our vibration data consisted of a scale from 0 – 5 indicating the magnitude of vibration. We began with a baseline of about 1.5, changing rapidly upon propellant ignition. As the vehicle ascended, we noted significant vibration change at launch, still increasing as our rocket approached apogee. We see a dip in vibration, followed by an abrupt increase which we can infer was our apogee target and first ejection charge. This occurred at approximately 16 seconds. The descent consistently read at or about 5 for most of its duration. A few dips in vibration can be observed at 96 and 102 seconds likely corresponding to the second ejection charge and main chute deployment. We observe a 0 value between 107 and 108 seconds from launch which would indicate vehicle touchdown.

# Project Outcomes

## Lessons Learned

* Summarize any lessons learned over the course of the program (technical and/or project management)

## STEM Engagement

* Summarize any STEM Engagement that occurred in the community and outcomes

## Budget Summary

* Summarize the project budget summary – contrast predicted versus actual